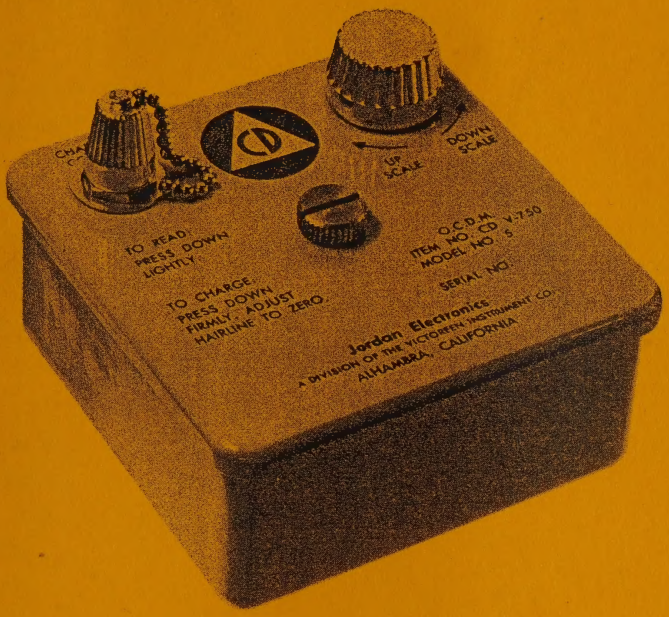
operating
and maintenance
INSTRUCTIONS



Radiological Dosimeter Charger

Jordan Model 750-5

OCDM Item No. CD V-750 — Model No. 5

Jordan Electronics
A DIVISION OF THE VICTOREEN INSTRUMENT COMPANY

ALHAMBRA, CALIFORNIA

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operating and maintenance instructions

1.0 GENERAL DESCRIPTION

The V-750 Radiological Dosimeter Charger supplies the voltage required to charge or "ZERO" quartz fibre dosimeters.

A transistor oscillator converts the direct current from a flashlight battery to alternating current so that the transformer can "step up" the battery voltage (1.5 volts) to the 220 volts required by the dosimeter. A voltage control is used to adjust the output voltage to the exact value required to bring the dosimeter to zero.

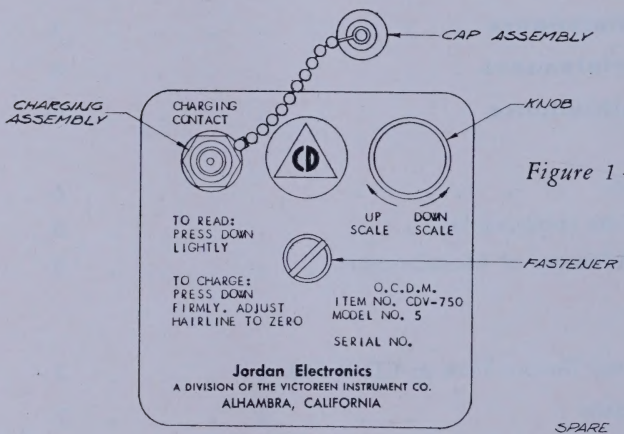


Figure 1 — Top View

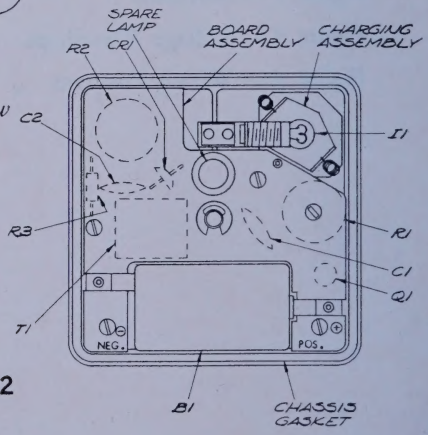


Figure 1 — Bottom View

2.0 THEORY OF OPERATION

The operation of the dosimeter charger circuit is governed mainly by the magnetic properties of the iron core of the transformer. The transistor serves as a switch to control the flow of current through the transformer primary winding.

Refer to the circuit schematic Fig. 2, page 7.

The switch SW_1 is closed when the charging pedestal is depressed by the dosimeter. Current flows from the positive (+) electrode of the battery B through the bulb I to provide illumination for the dosimeter scale.

A small current flows from the positive (+) electrode of the battery into the transistor emitter (e) and out of the base (b) through the transformer winding N_1 and then through the lower portion of the potentiometer resistor R_1 back to the negative (—) electrode of the battery B.

The small current flowing out of the base (b) of the transistor allows the flow of a much larger current out of the collector (c). This large current flows through the transformer winding N_2 and back to the negative (—) electrode of the battery B.

The current through N_2 creates a magnetic flux in the transformer core. The increase of flux induces a voltage in N_1 that tends to drive the base (b) of the transistor more negative and causes more base current to flow. This in turn causes more collector current to flow and so on until the transistor becomes "saturated" and no further increase takes place. This action is completed very rapidly.

The voltage induced in the other windings by the current through N_2 depends on the rate of increase of the magnetic flux in the transformer core. When the core becomes fully magnetized, the flux can increase no more and, therefore, the rate of increase drops to zero and transformer action ceases.

When the core becomes magnetized and transformer action ceases, the voltage induced in N_1 and applied to the base of the transistor drops to zero and the transistor collector current stops flowing. Now, with no current flowing through N_2, the magnetic flux in the transformer drops very rapidly. This rapid reverse change in flux induces a large reverse voltage in the secondary winding N_3 for a short period of time. This completes the cycle and the process repeats itself as long as the switch SW remains closed.

Each high voltage pulse in the secondary N_3 causes current to flow into the capacitor C_2 for a short period of time. The energy of the pulse is stored in the capacitor and the voltage across the capacitor can be "pumped up" by these repetitive high voltage pulses to nearly the peak voltage of the pulses. The rectifier diode CR_1 passes only positive pulses to the capacitor C_2.

The waveshape seen with an oscilloscope connected to the secondary N_3 is shown on page 7 .

The potentiometer resistor R_2 and the fixed resistor R_3 serve as a voltage divider across the capacitor. The potentiometer R_2 is the control used to adjust the voltage applied to the dosimeter at the charging pedestal J_1.

During the interval between pulses, part of the charge on C_2 leaks off through R_2 and R_3. Therefore, a fast pulse repetition rate will result in the highest voltage on C_2. The repetition rate, and thus the voltage on C_2 is controlled by the potentiometer resistor R_1. R_1 is used as an internal calibration adjustment to obtain the proper voltage range to charge dosimeters.

The capacitor C_1 provides a low impedance a.c. path from N_1 to the emitter so that the base end of N_1 will provide the required base signal.

3.0 INSTALLATION

Preparation of the dosimeter charger for operation is quite simple. Remove the case by loosening the case fastener. The knurled head can be turned with the fingers or, if it is too tight, with a coin inserted in the slot.

Install the 'D' cell in the opening provided for it in the printed circuit board. Observe the polarity markings on the battery and the printed circuit. The battery will fit in the holder only one way. DO NOT attempt to force it into position.

Replace the case and tighten fastening screw with fingers.

Unscrew the dust cap from the charging contact and the charger is ready for use.

4.0 OPERATION

4.1 dosimeter reading

To read a dosimeter, place it on the charging contact and press down lightly to switch on the light. Do not press harder than necessary or the reading will be lost.

4.2 dosimeter charging

To charge a dosimeter, press it down on the charging contact with sufficient force to bring the dosimeter body in contact with the threaded portion of the charging assembly.

This will provide sufficient force to actuate the charging switch in the dosimeter. Now read the dosimeter and adjust the control knob until the dosimeter indicates ZERO.

Remove the dosimeter from the charging contact.

4.3 emergency operation

When the 'D' cell is nearly discharged and a new one is not available, the dosimeter charger can still be made to operate. Two steps can be taken:

a. Open the case and, with a small screwdriver, adjust the calibration control R_1 in the direction marked DOWN SCALE. This will increase the charging voltage to compensate for the lost battery voltage.

b. If step "a" still does not provide sufficient voltage to bring the dosimeter to zero, remove the lamp I_1. The lamp requires much more current than the charging circuit. The battery may have enough energy to operate the charging circuit, but not the lamp.

   Without the lamp it will be necessary to make adjustments in small steps while reading the dosimeter each time with another source of illumination.

5.0 OPERATOR'S MAINTENANCE

Operator's maintenance should be limited to replacing the battery, cleaning the contacts and inspecting for visible faults. If the lamp appears dim or does not light, replace the battery. If operation is intermittent, clean the battery contacts.

If the lamp is bright, but the dosimeter cannot be brought to ZERO, try another dosimeter. If none of the dosimeters can be charged, check for contamination on the charging contact insulator or for a short circuit on the charging contact wire inside the charger.

6.0 PREVENTIVE MAINTENANCE

The only preventive maintenance required is removal of the battery when the dosimeter charger is to be stored, and cleaning the battery contacts if they appear corroded.

7.0 CORRECTIVE MAINTENANCE

When a malfunction cannot be corrected by the steps outlined in Section 5, further steps can be taken by a competent electronic technician.

Reference should be made to the schematic diagram, figure 2 and the wiring diagram, figure 4 on page 7.

Improper adjustment of the internal calibration control R_1 can prevent operation. To adjust R_1, turn the control knob R_2 full clockwise. Connect the negative lead of 20,000 ohm/V multimeter (Simpson 260 or equal) to the chassis. Set the meter to the 250V DC range. Connect the positive lead to the charging contact wire. Depress the charging pedestal to close the switch.

Starting from the full clockwise position, turn R_1 counter-clockwise until the meter indicates 57 volts.

If no voltage is obtained, replace the transistor. Almost any small PNP transistor will probably work.

If a new transistor doesn't work, remove both C_1 and C_2 and check for shorts with an ohmmeter. Check the rectifier diode CR_1 with an ohmmeter. Set the meter to the RX10 scale. With the meter leads connected one way, it should show a short, and the other way an open. If it shows a short or open both ways, replace it.

Check R_1 and R_2 with an ohmmeter. Check the transformer windings for continuity and interwinding shorts with an ohmmeter.

Inspect the printed circuit for damage and check all connections to it.

Across winding N_3 the waveform should look like the sketch in figure 3, and may be observed on an oscilloscope.

8.0 PARTS LIST

8.1 electrical parts

Circuit Symbol	Description and Function	Mfgr. & Part No.	Jordan Part No.	Recommended Spares
B_1	Battery, 'D' Cell	Everready 950	BA-0005	10
C_1	Capacitor, Ceramic Disc. .05 mf 50V (Base Drive Capacitor)	RI K500-01	CC-0024	1
C_2	Capacitor, Ceramic Disc. .01 mf 500V (High Voltage Filter)	RI K500-05	CC-0014	2
CR_1	Diode (High voltage Rectifier) 250P.I.V.	Intl. RC 66-4195	QD-0021	1
I_1	Lamp (Scale Illumination) I-131	GE-131	EL-0003	2
Q_1	Transistor (Oscillator) PNP	U.S. TO-12	QT-0033	2
R_1	Potentiometer (Calibrate) 15K ¼W 30%	CTS UPM-45 (32007)	RP-0153	1
R_2	Potentiometer (Control) 10meg ¼W 20%	CTS UP-45 (31998)	RP-0106	2
R_3	Resistor, carbon (voltage divider) 4.7 meg ½W 10%	IRC GBT ½	RC 0475	2
T_1	Transformer (Oscillator)	JORDAN	TS-0026	1

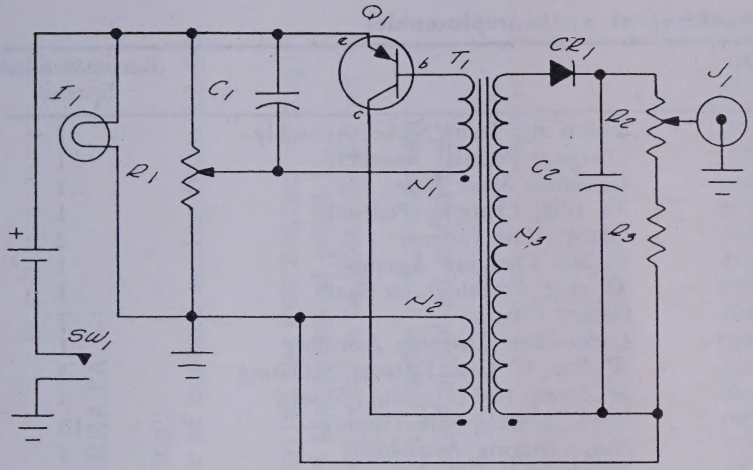


Figure 2 — Schematic

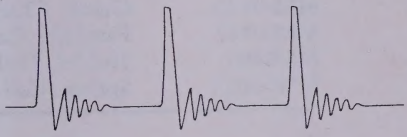


Figure 3 — Voltage Waveshape

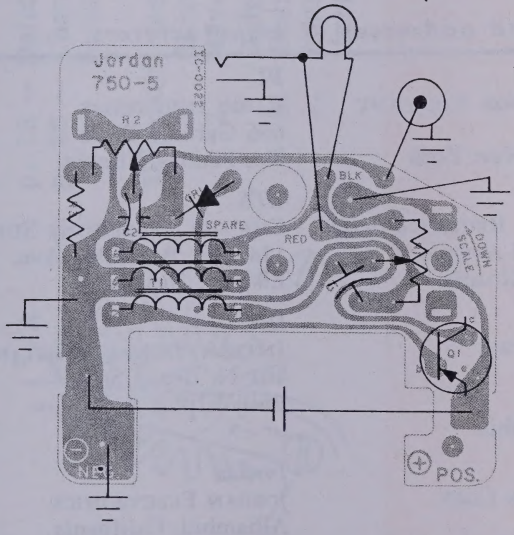


Figure 4 — Wiring Diagram

8.2 mechanical parts (replaceable)

Jordan Part No.		Recommended Spares
AE-0178	Switch and Lamp Socket Assembly	1
AI-0027	Charging Pedestal Assembly	1
HG-0016	Grommet, Spare Bulb	1
HG-0036	'O' ring, Charging Pedestal	1
HG-0084	Gasket, Case Fastener	2
HG-0085	Gasket, Charging Assembly	1
HG-0086	'O' ring, Potentiometer Shaft	1
HG-0087	Gasket, Chassis	2
HW-1007	Lockwasher, Charging Assembly	1
HX-0285	Washer 'C' Case Fastener Retaining	5
HX-0286	Set Screw 10-32x1/4 Cup, Slotted	5
HX-0290	Screw, 4-40x1/4 Self Tapping	10
HX-0291	Nut, Charging Assembly	5
IC-0022	Board, Printed Circuit	2
MD-0013	Chassis	1
MD-0014	Knob, Control	1
MM-0445	Guide, Charging Pedestal	1
MM-0447	Fastener, Case	1
MS-0495	Holder, Coil Spring	1
MW-0023	Spring, Coil Pedestal Return	5

8.3 names and addresses of manufacturers

Eveready
NATIONAL CARBON COMPANY
30 East 42nd St.
New York 17, New York

Intl. RC
INTERNATIONAL RECTIFIER CORP.
1521 East Grand Avenue
El Segundo, California

GE
GENERAL ELECTRIC
LAMP DIVISION
Nela Park
Cleveland 12, Ohio

U.S.
U. S. TRANSISTOR CORP.
149 Eileen Way
Syosset, New York

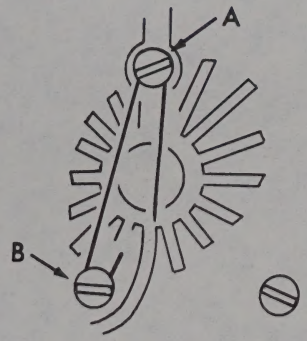
RI
RADIO INDUSTRIES
666 Garland Place
Des Plaines, Illinois

CTS
CHICAGO TELEPHONE SUPPLY CORP.
1142 W. Beardsley Ave.
Elkhart, Indiana

IRC
INTERNATIONAL RESISTANCE CO.
401 N. Broad St.
Philadelphia 8, Pa.

Jordan
JORDAN ELECTRONICS
Alhambra, California

ERRATA



p. 16 — Delete "contact spring"

p. 20 — Change part number of contact spring from 12-39 to 817-77

To modify instruments not having the new contact spring:

1. Remove and discard the screw at point B.
2. Move the screw from point A to point B; do not tighten.
3. Position the spring as shown in the diagram.
4. Install the 5/16" screw supplied at point A; tighten both screws.